AUTOMATIC GAIN CONTROL METHOD AND APPARATUS IN COMMUNICATION SYSTEM HAVING DISCONTINUOUS TRANSMISSION MODE

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Commissioner for Patents
P.O. Box 1450
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Subject: Appeal Brief
Sir:

Please find attached an Appeal Brief in accordance with 37 C.F.R. 41.37 in response to the Office action of September 20, 2007:

APPEAL BRIEF

This is an appeal in accordance with 37 C.F.R. 41.37 in response to the Office action mailed 09/20/2007 rejecting claims 1-27 of application serial no. 10/708,941.

REAL PARTY IN INTEREST (37 C.F.R. 41.37 (c)(i))

The real part of interest is the assignee: MediaTek Inc., No.1, Dusing Rd. 1, HsinChu Science-Based Industrial Park, HsinChu, Taiwan 300, R.O.C.

RELATED APPEALS AND INTERFERENCES (37 C.F.R. 41.37 (c)(ii))

None.

STATUS OF CLAIMS (37 C.F.R. 1.92(c)(iii))

Claims 1-27: Rejected

STATUS OF AMENDMENTS (37 C.F.R. 41.37 (c)(iv))

No amendment has been filed subsequent to final rejection.

SUMMARY OF THE INVENTION (37 C.F.R. 41.37 (c)(v))

The invention, as illustrated in Figs.2 and 3 and described in paragraphs 0016 to 0021, provides an automatic gain control method used in a wireless receiver. Initially, a frame A is received via the antenna 10. Then the receiver module 12 is used to amplify a RF signal corresponding to the frame A with a gain value and down convert the RF signal to generate a baseband signal.

Next, the baseband signal is converted to a digital signal via the analog-to-digital converter 14. The digital signal processing module 8 is used to estimate the power

level P_A of the baseband signal corresponding to the frame A, and the automatic gain control module 20 is used to update the gain value according to the power level P_A. If the power level P_A is smaller or larger than a desired power level, the gain value is increased or decreased. The updated gain value is for amplifying a RF signal corresponding to a second frame B when receiving the second frame B.

Then the discontinuous transmission mode detection module 18 is utilized to determine whether the signal block A is in the discontinuous transmission mode or not. If it is in discontinuous mode, the automatic gain control module 20 is used to resume the gain value according to the power level of the baseband signal corresponding to a frame C, wherein the frame C belongs to a signal block C which is sent before the signal block A, and where the signal block C is not in the discontinuous transmission mode.

GROUNDS OF REJECTIONS TO BE REVIEWED (37 C.F.R. 41.37 (c)(vi))

Issue 1: Whether claims 1, 8-10, 17-19, 26, and 27 are anticipated under 35 U.S.C. §102(b) over Stoter et al. (US 2003/0026363, "Stoter" hereinafter).

ARGUMENT (37 C.F.R. 41.37 (c)(vii))

Re: Issue 1

Overview

Stoter discloses a method for controlling the automatic gain, such that the received signal can be adjusted to a desired dynamic range, and the bit error of the data block can be decreased thereby (Abstract). Also, Stoter utilizes the mechanism as follows to solve this problem: "*Before or at the very beginning when substantial data in a data block are processed in the amplifier the gain of that amplifier is rapidly adjusted or preset to a predetermined signal level for that data block. By adapting the gain of the amplifier before or just as the data in the block are processed by the amplifier before or just as the data in the block are processed by the amplifier to an*

appropriate level, the received signal can be adjusted to a desired dynamic range." (paragraph 0007).

However, the purpose of the present invention is to solve the problems in which the number of the frames utilized as samples for automatic gain control is too small (paragraph 0006). The mechanism utilized by the present invention to solve this problem is detecting if the signal block is in discontinuous mode, and utilizes all the frames in the signal block which is not in discontinuous mode as samples for performing gain control. (paragraph 0029).

Therefore, the main purpose and the main mechanism of the present invention and Stoter are substantially different.

Claim 1

The examiner states that the characteristic of "determining if the signal block is in discontinuous transmission or rapidly changing mode then using the gain value of the AGC based upon the previous frame" is disclosed in paragraphs 0005, 0006, 0031, 0043, 0046 of Stoter.

However, paragraphs 0005 and 0006 only describes that there are times when a receiver does not receive a continuous signal or the signal level varies dramatically in short periods of time. Stoter states "*In all of these circumstances, the receiver lacks an accurate starting point from which to start the automatic gain control. Essentially, the automatic gain control starts from "zero" and must "catch-up" to the power level of the received synchronization signal. During this delay or lag time while the AGC catches up with the power level of the received signal, the AGC is not properly calibrated, which creates errors in demodulating the data. It may even result in delayed synchronization if the data is missed or otherwise lost in error or noise*" (paragraph 0005).

Paragraph 0031 of Stoter discloses that the signal level differs apparently if the signal is in discontinuous mode. As described above, Stoter discloses a method for

controlling the automatic gain, such that the received signal can be adjusted to a desired dynamic range, and the bit error of the data block can be decreased thereby (Abstract). Paragraph 0043 of Stoter discloses the detailed steps for utilizing an AGC method to solve the rapid changing signal levels of rapid changing signal, that is, the detailed description of Fig.10. Paragraph 0046 of Stoter discloses what advantage will be obtained if the method shown in Fig.10, 11, and 12 is applied to a discontinuous system. None of these cited **paragraphs teach or indicate that Stoter utilizes any mechanism to detect if the received signal is in discontinuous mode, and adjust the gain value according the mode of the signal**, which are claimed limitations of the present invention, as described above.

Additionally, claim 1 further includes limitations of "**resuming** the gain value according to **the power level of the baseband signal corresponding to a third frame** if the first signal block is in the discontinuous transmission mode", and "**the third frame** belongs to a third signal block which is sent before the first signal block and the third signal block **is not in the discontinuous transmission mode**". However, the appellant asserts above limitations are not taught or suggested by Stoter's teachings. Since Stoter does not classify received signal blocks as being in continuous transmission mode or discontinuous transmission mode, Stoter does not teach these claimed limitations.

In light of above statements, the appellant submits that Stoter does not anticipate all of the limitations contained in claim 1.

Claims 10 and 19

Independent claims 10 and 19 are corresponding apparatus claims of claim 1, which also include the limitation of "detecting the discontinuous mode" and "resuming the gain value according to the power level of the baseband signal corresponding to a third frame if the first signal block is in the discontinuous transmission mode". Therefore, the appellant submits that claims 10 and 19 are patentable over Stoter as well.

Claims 2-9, 11-18, and 20-27

Claims 2-9, 11-18, and 20-27 are dependent upon respective claims 1, 10, and 19, and should be allowed if claims 1, 10, and 19 are found allowable.

Sincerely yours,

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APPENDIX – LIST OF CLAIMS UNDER APPEAL (37 C.F.R. 41.37 (c)(viii))

1. An automatic gain control method used in a wireless receiver, the wireless receiver being for receiving a plurality of signal blocks sent by a wireless transmitter, each of the plurality of signal blocks comprising at least one frame, the wireless transmitter having a discontinuous transmission mode, the method comprising:

receiving a first frame, amplifying a RF signal corresponding to the first frame with a gain value and down converting the RF signal to generate a baseband signal;

updating the gain value according to the power level of the baseband signal corresponding to the first frame, wherein the updated gain value is for amplifying the RF signal corresponding to a second frame when receiving the second frame;

determining whether a first signal block is in the discontinuous transmission mode or not, wherein the first frame belongs to the first signal block; and

resuming the gain value according to the power level of the baseband signal corresponding to a third frame if the first signal block is in the discontinuous transmission mode;

wherein the third frame belongs to a third signal block which is sent before the first signal block and the third signal block is not in the discontinuous transmission mode.

2. The automatic gain control method of claim 1, wherein:

the wireless transmitter transmits the RF signal in a frequency hopping manner; and

the first frame, the second frame, and the third frame correspond to the same channel frequency.

3. The automatic gain control method of claim 1, wherein:

the wireless transmitter transmits the RF signal with a single channel frequency;

the second frame is the one sent immediately after the first frame; and

the third frame is the last frame of the third signal block.

4. The automatic gain control method of claim 1, wherein determining whether the first signal block is in the discontinuous transmission mode or not further comprises:

computing a first number of valid frames belonged to the first signal block;

comparing the first number with a predefined number;

determining that the first signal block is not in the discontinuous transmission mode if the first number is larger than or equal to the predefined number; and

determining that the first signal block is in the discontinuous transmission mode if the first number is smaller than the predefined number.

5. The automatic gain control method of claim 4, wherein computing the first number of valid frames belonged to the first signal block further comprises:

estimating a signal quality metric for each frame belonged to the first signal block;

if a frame has a signal quality metric which is larger than a predefined quality metric, then regarding the frame as a valid frame; and

computing the first number of valid frames belonged to the first signal block.

6. The automatic gain control method of claim 5, wherein the signal quality metric is a signal-to-noise ratio of the frame belonged to the first signal block.

7. The automatic gain control method of claim 5, wherein the signal quality metric is a signal power level of the frame belonged to the first signal block.

8. The automatic gain control method of claim 1, wherein updating the gain value according to the power level of the baseband signal corresponding to the first frame further comprises:

comparing the power level of the baseband signal corresponding to the first frame with a desired power level;

increasing the gain value if the power level of the baseband signal corresponding to the first frame is smaller than the desired power level; and

decreasing the gain value if the power level of the baseband signal corresponding to the first frame is not smaller than the desired power level.

9. The automatic gain control method of claim 8, wherein the baseband signal corresponding to the first frame is an input signal of an analog-to-digital converter used in the wireless receiver.

10. A wireless receiver for receiving a plurality of signal blocks sent by a wireless transmitter, each of the plurality of signal blocks comprising at least one frame, the wireless transmitter having a discontinuous transmission mode, the wireless receiver comprising:

an antenna for receiving a RF signal corresponding to a first frame of a first signal block sent by the wireless transmitter;

a receiver module connected to the antenna for amplifying the RF signal corresponding to the first frame with a gain value and down converting the RF signal to generate a baseband signal;

a discontinuous transmission detection module connected to the receiver module for determining whether the first signal block is in the discontinuous transmission mode or not;

a gain control module connected to the receiver module and the discontinuous transmission detection module for adjusting the gain value used by the receiver module;

wherein after receiving the first frame of the first signal block, the gain control module updates the gain value according to the power level of the baseband signal corresponding to the first frame; then the receiver module uses the updated gain value for amplifying the RF signal corresponding to a second frame when receiving the second frame; and if the discontinuous transmission detection module determines that the first signal block is in the discontinuous transmission mode, the gain control module resumes the gain value according to the power level of the baseband signal corresponding to a

third frame that belongs to a third signal block sent before the first signal block and the third signal block is not in the discontinuous transmission mode.

11. The wireless receiver of claim 10, wherein:
the wireless transmitter transmits the RF signal in a frequency hopping manner; and
the first frame, the second frame, and the third frame correspond to the same channel frequency.

12. The wireless receiver of claim 10, wherein:
the wireless transmitter transmits the RF signal with a single channel frequency;
the second frame is the one sent immediately after the first frame; and
the third frame is the last frame of the third signal block.

13. The wireless receiver of claim 10, wherein the discontinuous transmission detection module determines whether a first signal block is in the discontinuous transmission mode or not by comparing a first number with a predefined number; the first number corresponds to the number of valid frames belonged to the first signal block; if the first number is not smaller than the predefined number, then the discontinuous transmission detection module determines that the first signal block is not in the discontinuous transmission mode, otherwise the discontinuous transmission detection module determines that the first signal block is in the discontinuous transmission mode.

14. The wireless receiver of claim 13, wherein for computing the first number of valid frames belong to the first signal block, the discontinuous transmission detection module estimates a signal quality metric for each frame belonged to the first signal block; if a frame has a signal quality metric which is larger than a predefined quality metric, then the discontinuous transmission detection module regards the frame as a valid frame.

15. The wireless receiver of claim 14, wherein the signal quality metric is a signal-to-noise ratio of the frame belonged to the first signal block.

16. The wireless receiver of claim 14, wherein the signal quality metric is a signal power level of the frame belonged to the first signal block.

17. The wireless receiver of claim 10, wherein for updating the gain value according to the power level of the baseband signal corresponding to the first frame, the gain control module compares the power level of the baseband signal corresponding to the first frame with a desired power level, and increases the gain value if the power level of the baseband signal corresponding to the first frame is smaller than the desired power level, otherwise the gain control module decreases the gain value.

18. The wireless receiver of claim 10, wherein the wireless receiver further comprises an analog-to-digital converter for converting the baseband signal corresponding to the first frame to a digital signal.

19. An automatic gain control apparatus applied in a wireless receiver, the wireless receiver receiving a plurality of signal blocks sent by a wireless transmitter, each of the plurality of signal blocks comprising at least one frame, the wireless receiver having a receiver module for amplifying a received RF signal corresponding to a first frame with a gain value and down converting the RF signal to generate a baseband signal, the wireless transmitter having a discontinuous transmission mode, the apparatus comprising:

a discontinuous transmission detection module connected to the receiver module for determining whether a first signal block is in the discontinuous transmission mode or not, wherein the first signal block contains the first frame;

a gain control module connected to the receiver module and the discontinuous transmission detection module for adjusting the gain value used by the receiver module;

wherein after receiving the first frame of the first signal block, the gain control module updates the gain value according to the power level of the baseband signal corresponding to the first frame; then the receiver module uses the updated gain value for amplifying the RF signal corresponding to a second frame when receiving the second frame; and if the discontinuous transmission detection module determines that the first signal block is in the discontinuous transmission mode, the gain control module resumes the gain value according to the power level of the baseband signal corresponding to a third frame that belongs to a third signal block sent before the first signal block and the third signal block is not in the discontinuous transmission mode.

20. The automatic gain control apparatus of claim 19, wherein:
the wireless transmitter transmits the RF signal in a frequency hopping manner; and
the first frame, the second frame, and the third frame correspond to the same channel frequency.

21. The automatic gain control apparatus of claim 19, wherein:
the wireless transmitter transmits the RF signal with a single channel frequency;
the second frame is the one sent immediately after the first frame; and
the third frame is the last frame of the third signal block.

22. The automatic gain control apparatus of claim 19, wherein the discontinuous transmission detection module determines whether a first signal block is in the discontinuous transmission mode or not by comparing a first number with a predefined number; the first number corresponds to the number of valid frames belonged to the first signal block; if the first number is not smaller than the predefined number, then the discontinuous transmission detection module determines that the first signal block is not in the discontinuous transmission mode, otherwise the discontinuous transmission detection module determines that the first signal block is in the discontinuous transmission mode.

23. The automatic gain control apparatus of claim 22, wherein for computing the first number of valid frames belong to the first signal block, the discontinuous transmission detection module estimates a signal quality metric for each frame belonged to the first signal block; if a frame has a signal quality metric which is larger than a predefined quality metric, then the discontinuous transmission detection module regards the frame as a valid frame.

24. The automatic gain control apparatus of claim 23, wherein the signal quality metric is a signal-to-noise ratio of the frame belonged to the first signal block.

25. The automatic gain control apparatus of claim 23, wherein the signal quality metric is a signal power level of the frame belonged to the first signal block.

26. The automatic gain control apparatus of claim 19, wherein for updating the gain value according to the power level of the baseband signal corresponding to the first frame, the gain control module compares the power level of the baseband signal corresponding to the first frame with a desired power level, and increases the gain value if the power level of the baseband signal corresponding to the first frame is smaller than the desired power level, otherwise the gain control module decreases the gain value.

27. The automatic gain control apparatus of claim 19, wherein the wireless receiver further comprises an analog-to-digital converter for converting the baseband signal corresponding to the first frame to a digital signal.